

WEST Search History

DATE: Friday, December 13, 2002

<u>Set Name</u>	<u>Query</u>	<u>Hit Count</u>	<u>Set Name</u>
side by side			result set
<i>DB=USPT,PGPB,JPAB,EPAB,DWPI; PLUR=YES; OP=ADJ</i>			
L5	L4 NEAR10 (VARIANT OR MUTA?)	17	L5
L4	(MYCELLIOPHTHORA OR THERMOPHILA) NEAR10 LACCASE	128	L4
L3	(MYCELLOPHTHORA OR THERMOPHILLA) AND LACCASE	3	L3
L2	(MYCELLOPHTHORA OR THERMOPHILLA) NEAR10 LACCASE	0	L2
L1	(MYCELLOPHTHORA OR THERMOPHILLA) NEAR10 LACCASE	0	L1

END OF SEARCH HISTORY

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[Generate Collection](#)[Print](#)

Search Results - Record(s) 1 through 10 of 17 returned.

☐ 1. Document ID: US 20020170122 A9

L5: Entry 1 of 17

File: PGPB

Nov 21, 2002

PGPUB-DOCUMENT-NUMBER: 20020170122
PGPUB-FILING-TYPE: corrected
DOCUMENT-IDENTIFIER: US 20020170122 A9

TITLE: Compositions for the oxidation dyeing of keratinous fibers comprising at least one oxidation dye and at least one enzymatic oxidizing agent, and dyeing methods

PUBLICATION-DATE: November 21, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Plos, Gregory	Paris		FR	

US-CL-CURRENT: [8/405](#); [8/406](#), [8/415](#), [8/416](#), [8/421](#), [8/423](#)

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments	Claims	RWC	Draw Desc	Image
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☐ 2. Document ID: US 20020034488 A1

L5: Entry 2 of 17

File: PGPB

Mar 21, 2002

PGPUB-DOCUMENT-NUMBER: 20020034488
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20020034488 A1

TITLE: Oxidizing composition and uses for dyeing, permanently reshaping or bleaching keratin fibres

PUBLICATION-DATE: March 21, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Kravtchenko, Sylvain	Asnieres		FR	
Plos, Gregory	Paris		FR	

US-CL-CURRENT: [424/70.14](#); [424/94.4](#)

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments	Claims	RWC	Draw Desc	Image
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☐ 3. Document ID: US 20020020029 A1

L5: Entry 3 of 17

File: PGPB

Feb 21, 2002

PGPUB-DOCUMENT-NUMBER: 20020020029

PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20020020029 A1

TITLE: Composition for the oxidation dyeing of keratinous fibers comprising at least one 1-(4-aminophenyl)pyrrolidine oxidation dye and at least one enzymatic oxidizing system, and dyeing methods

PUBLICATION-DATE: February 21, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Kravtchenko, Sylvain	Asnieres		FR	
Plos, Gregory	Paris		FR	

US-CL-CURRENT: 8/405; 8/406, 8/421

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments	Claims	KIMC	Draw Desc	Image
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☐ 4. Document ID: US 20020016998 A1

L5: Entry 4 of 17

File: PGPB

Feb 14, 2002

PGPUB-DOCUMENT-NUMBER: 20020016998
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20020016998 A1

TITLE: USE OF HYDROXYSTILBENES FOR DYEING, READY-TO-USE COMPOSITION CONTAINING THEM AND DYEING PROCESS

PUBLICATION-DATE: February 14, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Pruche, Francis	Paris		FR	
Saint Leger, Didier	Courbevoie		FR	
Bernard, Bruno	Neuilly-Sur-Seine		FR	

US-CL-CURRENT: 8/401

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments	Claims	KIMC	Draw Desc	Image
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☐ 5. Document ID: US 20020013973 A1

L5: Entry 5 of 17

File: PGPB

Feb 7, 2002

PGPUB-DOCUMENT-NUMBER: 20020013973
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20020013973 A1

TITLE: Compositions for the oxidation dyeing of keratinous fibers comprising at least one oxidation dye and at least one enzymatic oxidizing agent, and dyeing methods

PUBLICATION-DATE: February 7, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Plos, Gregory	Paris		FR	

US-CL-CURRENT: [8/405](#); [8/406](#), [8/415](#), [8/416](#), [8/421](#), [8/423](#)

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments
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KM/C	Draw Desc	Image
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☐ 6. Document ID: US 20010031490 A1

L5: Entry 6 of 17

File: PGPB

Oct 18, 2001

PGPUB-DOCUMENT-NUMBER: 20010031490

PGPUB-FILING-TYPE: new

DOCUMENT-IDENTIFIER: US 20010031490 A1

TITLE: Laccase mutants

PUBLICATION-DATE: October 18, 2001

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Svensden, Allan	Birkerod	CA	DK	
Xu, Feng	Woodland		US	

US-CL-CURRENT: [435/189](#); [435/325](#), [435/69.1](#), [510/305](#)

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments
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KM/C	Draw Desc	Image
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☐ 7. Document ID: US 6409772 B1

L5: Entry 7 of 17

File: USPT

Jun 25, 2002

US-PAT-NO: 6409772

DOCUMENT-IDENTIFIER: US 6409772 B1

TITLE: Use of hydroxystilbenes for dyeing, ready-to-use composition containing them and dyeing process

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments
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KM/C	Draw Desc	Image
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☐ 8. Document ID: US 6277611 B1

L5: Entry 8 of 17

File: USPT

Aug 21, 2001

US-PAT-NO: 6277611

DOCUMENT-IDENTIFIER: US 6277611 B1

TITLE: Laccase mutants

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments
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KM/C	Draw Desc	Image
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☐ 9. Document ID: US 6140092 A

L5: Entry 9 of 17

File: USPT

Oct 31, 2000

US-PAT-NO: 6140092
DOCUMENT-IDENTIFIER: US 6140092 A

TITLE: Laccase mutants

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments	KWIC	Draw Desc	Image
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☐ 10. Document ID: US 5998353 A

L5: Entry 10 of 17File: USPTDec 7, 1999

US-PAT-NO: 5998353
DOCUMENT-IDENTIFIER: US 5998353 A

TITLE: Laccase mutants

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments	KWIC	Draw Desc	Image
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Generate Collection

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Terms	Documents
L4 NEAR10 (VARIANT OR MUTA?)	17

Display Format: -

Change Format

[Previous Page](#)

[Next Page](#)

WEST



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L5: Entry 6 of 17

File: PGPB

Oct 18, 2001

DOCUMENT-IDENTIFIER: US 20010031490 A1

TITLE: Laccase mutants

CLAIMS:

15. A variant of a parent Myceliophthora thermophila laccase, which variant has an increased oxidation potential and comprises a mutation in a position corresponding to at least one of the following positions in SEQ ID No. 10: G511A,V,P,L,I,F,Y,W; T428A,V,P,L,I,F,Y,W; S510A,V,P,L,I,F,Y,W; D106A,V,P,L,I,F,Y,W; N109A,V,P,L,I,F,Y,W,Q; L500I,F,Y,W; A108V,P,L, I,F,Y,W; G514A,V,P,L,I,F,Y,W.

16. A variant of a parent Myceliophthora thermophila laccase, which variant has an altered pH optimum and comprises a mutation in a position corresponding to at least one of the following positions in SEQ ID No. 10: 192-193; 234-236; 269; 293-294; 364-365; 372-373; 426-433; 503-513.

17. A variant of a parent Myceliophthora thermophila laccase, which variant has an altered mediator efficiency and comprises a mutation in a position corresponding to at least one of the following positions in SEQ ID No. 10: 185-194; 235; 293-294; 365-373; 427-429; 505; 507-508; 510-511.

18. A variant of a parent Myceliophthora thermophila laccase, which variant has an altered O.sub.2/OH-pathway and comprises a mutation in a position corresponding to at least one of the following positions in SEQ ID No. 10: A506E; N109D; H93E; H95E; M433E; M480E.

WEST☐ **Generate Collection** **Print**

L5: Entry 8 of 17

File: USPT

Aug 21, 2001

US-PAT-NO: 6277611

DOCUMENT-IDENTIFIER: US 6277611 B1

TITLE: Laccase mutants

DATE-ISSUED: August 21, 2001

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Pedersen; Anders Hjelholt	Lyngby			DK
Svendsen; Allan	Birker.o slashed.d			DK
Schneider; Palle	Ballerup			DK
Rasmussen; Grethe	Farum			DK
Cherry; Joel	Hellerup			DK

US-CL-CURRENT: 435/189

CLAIMS:

What is claimed is:

1. A variant of a parent Polyporus pinsitus (I) laccase, which comprises a mutation in a position corresponding to at least one of the following positions in SEQ ID No. 2:

W107,

Y116,

Y108,

Y152,

M57, and/or

M328.

2. A variant of a parent Polyporus pinsitus (II) laccase, which comprises a mutation in a position corresponding to at least one of the following positions in SEQ ID No. 3:

W107,

Y116,

Y108,

Y152; and/or

M57.

3. A variant of a parent Phlebia radiata laccase, which comprises a mutation in a position corresponding to at least one of the following positions in SEQ ID No.

4:

W128,

Y137,

Y129,

Y137, and/or

M78.

4. A variant of a parent *Rhizoctonia solani* (I) laccase, which comprises a mutation in a position corresponding to at least one of the following positions in SEQ ID No. 5:

W126,

Y135,

Y127,

Y171, and/or

M76.

5. A variant of a parent *Rhizoctonia solani* (II) laccase, which comprises a mutation in a position corresponding to at least one of the following positions in SEQ ID No. 6:

W439,

W125,

Y134,

Y126,

Y170, and/or

M75.

6. A variant of a parent *Rhizoctonia solani* (III) laccase, which comprises a mutation in a position corresponding to at least one of the following positions in SEQ ID No. 7:

W411,

W125,

Y134,

Y126,

Y170, and/or

M75.

7. A variant of a parent *Rhizoctonia solani* (IV) laccase, which comprises a mutation in a position corresponding to at least one of the following positions in SEQ ID No. 8:

W411,

W125,

Y134,

Y126,

Y170, and/or

M75.

8. A variant of a parent *Scytalidium thermophilum* laccase, which comprises a mutation in a position corresponding to at least one of the following positions in SEQ ID No. 9:

M483,

W422,

W181,

Y190,

M530,

Y182,

Y221,

M300, and/or

M313.

9. A variant of a parent *Myceliophthora thermophila* laccase, which comprises a mutation in a position corresponding to at least one of the following positions in SEQ ID No. 10:

W507,

M433,

W373,

W136,

Y145,

M480,

Y137,

Y176, and/or

M254.

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L5: Entry 15 of 17

File: DWPI

Nov 8, 2001

DERWENT-ACC-NO: 2002-041497

DERWENT-WEEK: 200222

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TITLE: New laccase variants from *Coprinus* and *Myceliophthora thermophila* with improved oxidative stability, useful for paper strengthening, dye transfer inhibition, bleaching of textiles and waste water treatment

INVENTOR: DANIELSEN, S; SCHNEIDER, P ; SVENDSEN, A

PATENT-ASSIGNEE: NOVOZYMES AS (NOVO)

PRIORITY-DATA: 2001US-277817P (March 21, 2001), 2000DK-0000707 (April 28, 2000), 2000US-203345P (May 10, 2000), 2001DK-0000327 (February 28, 2001)

PATENT-FAMILY:

PUB-NO	PUB-DATE	LANGUAGE	PAGES	MAIN-IPC
WO 200183761 A1	November 8, 2001	E	154	C12N015/53
AU 200154622 A	November 12, 2001		000	C12N015/53

DESIGNATED-STATES: AE AG AL AM AT AU AZ BA BB BG BR BY BZ CA CH CN CO CR CU CZ DE DK DM DZ EE ES FI GB GD GE GH GM HR HU ID IL IN IS JP KE KG KP KR KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX MZ NO NZ PL PT RO RU SD SE SG SI SK SL TJ TM TR TT TZ UA UG US UZ VN YU ZA ZW AT BE CH CY DE DK EA ES FI FR GB GH GM GR IE IT KE LS LU MC MW MZ NL OA PT SD SE SL SZ TR TZ UG ZW

APPLICATION-DATA:

PUB-NO	APPL-DATE	APPL-NO	DESCRIPTOR
WO 200183761A1	April 30, 2001	2001WO-DK00292	
AU 200154622A	April 30, 2001	2001AU-0054622	
AU 200154622A		WO 200183761	Based on

INT-CL (IPC): C11 D 3/386; C12 N 1/15; C12 N 1/21; C12 N 9/02; C12 N 15/53; C12 N 15/63; D06 M 16/00; C12 R 1:69; C12 R 1:685; C12 R 1:645; C12 N 9/02; C12 N 1/15

RELATED-ACC-NO: 2001-626552;2002-062127

ABSTRACTED-PUB-NO: WO 200183761A

BASIC-ABSTRACT:

NOVELTY - A variant (I) of a parent *Coprinus* laccase comprising a mutation which improves the oxidative stability of the variant as compared to the parent laccase and a variant (II) of a parent *Myceliophthora thermophila* laccase, are new.

DETAILED DESCRIPTION - (I) comprises a mutation in a position corresponding to one of the positions F21, H91, F112, H133, H153, Y176, H230, H309, F335, Y347, S349, Y375, Y416, F449, E455, F456 and/or Y490 of a sequence of 539 amino acids, and (II) comprises a mutation in a position corresponding to one of the positions V52, G121, F141, Y177, H206, M260, P336, V406, T365, I380, I382, A506, W507 and/or WW543 of a sequence of 573 amino acids fully defined in the specification.

INDEPENDENT CLAIMS are also included for the following:

- (1) a DNA construct (III) comprising a DNA sequence encoding (I) or (II);
- (2) a recombinant expression vector (IV) which carries (III);
- (3) a cell (V) which is transformed with (III) or (IV);
- (4) a detergent additive (VI) comprising (I) or (II) in the form of a non-dusting granulate, a stabilized liquid or protected enzyme; and
- (5) a detergent composition (VII) comprising (I) or (II) and a surfactant.

USE - (I) and (II) are useful for oxidizing a substrate, for dye transfer inhibition and for bleaching textiles, in particular for bleaching denim (claimed). The laccase variants are useful as detergent compositions in household hard surface cleaning operations, or formulated for hand or machine dishwashing operations, and in various industrial applications, in particular lignin modification, paper strengthening, phenol polymerization, hair dyeing and waste water treatment.

ADVANTAGE - The laccase variants have improved oxidative stability compared to the unmodified parent laccases, i.e. improved tolerance towards oxidative chemical compounds.

ABSTRACTED-PUB-NO: WO 200183761A

EQUIVALENT-ABSTRACTS:

CHOSEN-DRAWING: Dwg.0/0

DERWENT-CLASS: D16 D25

CPI-CODES: D05-A02; D05-H12E; D05-H14A1; D05-H14A2; D05-H17B3; D11-B01; D11-B02;

WEST[Generate Collection](#)[Print](#)**Search Results - Record(s) 11 through 17 of 17 returned.**☐ 11. Document ID: US 5972670 A

L5: Entry 11 of 17

File: USPT

Oct 26, 1999

US-PAT-NO: 5972670

DOCUMENT-IDENTIFIER: US 5972670 A

TITLE: Blue copper oxidase mutants with enhanced activity

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments	Claims	KIMC	Draw Desc	Image
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☐ 12. Document ID: US 5948121 A

L5: Entry 12 of 17

File: USPT

Sep 7, 1999

US-PAT-NO: 5948121

DOCUMENT-IDENTIFIER: US 5948121 A

TITLE: Laccases with improved dyeing properties

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments	Claims	KIMC	Draw Desc	Image
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☐ 13. Document ID: US 5925554 A

L5: Entry 13 of 17

File: USPT

Jul 20, 1999

US-PAT-NO: 5925554

DOCUMENT-IDENTIFIER: US 5925554 A

TITLE: Myceliophthora and scytalidium laccase variants

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments	Claims	KIMC	Draw Desc	Image
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☐ 14. Document ID: US 5770419 A

L5: Entry 14 of 17

File: USPT

Jun 23, 1998

US-PAT-NO: 5770419

DOCUMENT-IDENTIFIER: US 5770419 A

TITLE: Mutants of Myceliophthora laccase with enhanced activity

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments	Claims	KIMC	Draw Desc	Image
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☐ 15. Document ID: WO 200183761 A1 AU 200154622 A

L5: Entry 15 of 17

File: DWPI

Nov 8, 2001

DERWENT-ACC-NO: 2002-041497

DERWENT-WEEK: 200222

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TITLE: New laccase variants from Coprinus and Myceliophthora thermophila with improved oxidative stability, useful for paper strengthening, dye transfer inhibition, bleaching of textiles and waste water treatment

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments	Claims	KWIC	Draw Desc	Image
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☐ 16. Document ID: WO 9838287 A1 US 20010031490 A1 AU 9859833 A US 5985818 A EP 977833 A1 US 6184015 B1

L5: Entry 16 of 17

File: DWPI

Sep 3, 1998

DERWENT-ACC-NO: 1998-495393

DERWENT-WEEK: 200166

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TITLE: New variants of Coprinus and related laccases with increased oxidation potential - or altered pH optimum, or mediator or oxygen-hydroxide ion pathways, useful for oxidation, for inhibiting dye transfer and in bleaching textiles, especially as detergent additive

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments	KWIC	Draw Desc	Image
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☐ 17. Document ID: WO 9827198 A1 AU 9853101 A EP 956345 A1 US 5998353 A US 6140092 A US 6277611 B1

L5: Entry 17 of 17

File: DWPI

Jun 25, 1998

DERWENT-ACC-NO: 1998-362768

DERWENT-WEEK: 199831

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TITLE: New laccase variants with improved stability - having amino acid changes based on Coprinus laccase structure, used for e.g. oxidation, dye transfer inhibition or bleaching

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments	KWIC	Draw Desc	Image
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Terms	Documents
L4 NEAR10 (VARIANT OR MUTA?)	17

Display Format:

-

[Previous Page](#)

[Next Page](#)

WEST

Generate Collection

Print

L5: Entry 15 of 17

File: DWPI

Nov 8, 2001

DERWENT-ACC-NO: 2002-041497

DERWENT-WEEK: 200222

COPYRIGHT 2002 DERWENT INFORMATION LTD

TITLE: New laccase variants from *Coprinus* and *Myceliophthora thermophila* with improved oxidative stability, useful for paper strengthening, dye transfer inhibition, bleaching of textiles and waste water treatment

INVENTOR: DANIELSEN, S; SCHNEIDER, P ; SVENDSEN, A

PATENT-ASSIGNEE: NOVOZYMES AS (NOVO)

PRIORITY-DATA: 2001US-277817P (March 21, 2001), 2000DK-0000707 (April 28, 2000), 2000US-203345P (May 10, 2000), 2001DK-0000327 (February 28, 2001)

PATENT-FAMILY:

PUB-NO	PUB-DATE	LANGUAGE	PAGES	MAIN-IPC
WO 200183761 A1	November 8, 2001	E	154	C12N015/53
AU 200154622 A	November 12, 2001		000	C12N015/53

DESIGNATED-STATES: AE AG AL AM AT AU AZ BA BB BG BR BY BZ CA CH CN CO CR CU CZ DE DK DM DZ EE ES FI GB GD GE GH GM HR HU ID IL IN IS JP KE KG KP KR KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX MZ NO NZ PL PT RO RU SD SE SG SI SK SL TJ TM TR TT TZ UA UG US UZ VN YU ZA ZW AT BE CH CY DE DK EA ES FI FR GB GH GM GR IE IT KE LS LU MC MW MZ NL OA PT SD SE SL SZ TR TZ UG ZW

APPLICATION-DATA:

PUB-NO	APPL-DATE	APPL-NO	DESCRIPTOR
WO 200183761A1	April 30, 2001	2001WO-DK00292	
AU 200154622A	April 30, 2001	2001AU-0054622	
AU 200154622A		WO 200183761	Based on

INT-CL (IPC): C11 D 3/386; C12 N 1/15; C12 N 1/21; C12 N 9/02; C12 N 15/53; C12 N 15/63; D06 M 16/00; C12 R 1:69; C12 R 1:685; C12 R 1:645; C12 N 9/02; C12 N 1/15

RELATED-ACC-NO: 2001-626552;2002-062127

ABSTRACTED-PUB-NO: WO 200183761A

BASIC-ABSTRACT:

NOVELTY - A variant (I) of a parent *Coprinus* laccase comprising a mutation which improves the oxidative stability of the variant as compared to the parent laccase and a variant (II) of a parent *Myceliophthora thermophila* laccase, are new.

DETAILED DESCRIPTION - (I) comprises a mutation in a position corresponding to one of the positions F21, H91, F112, H133, H153, Y176, H230, H309, F335, Y347, S349, Y375, Y416, F449, E455, F456 and/or Y490 of a sequence of 539 amino acids, and (II) comprises a mutation in a position corresponding to one of the positions V52, G121, F141, Y177, H206, M260, P336, V406, T365, I380, I382, A506, W507 and/or WW543 of a sequence of 573 amino acids fully defined in the specification.

INDEPENDENT CLAIMS are also included for the following:

- (1) a DNA construct (III) comprising a DNA sequence encoding (I) or (II);
- (2) a recombinant expression vector (IV) which carries (III);
- (3) a cell (V) which is transformed with (III) or (IV);
- (4) a detergent additive (VI) comprising (I) or (II) in the form of a non-dusting granulate, a stabilized liquid or protected enzyme; and
- (5) a detergent composition (VII) comprising (I) or (II) and a surfactant.

USE - (I) and (II) are useful for oxidizing a substrate, for dye transfer inhibition and for bleaching textiles, in particular for bleaching denim (claimed). The laccase variants are useful as detergent compositions in household hard surface cleaning operations, or formulated for hand or machine dishwashing operations, and in various industrial applications, in particular lignin modification, paper strengthening, phenol polymerization, hair dyeing and waste water treatment.

ADVANTAGE - The laccase variants have improved oxidative stability compared to the unmodified parent laccases, i.e. improved tolerance towards oxidative chemical compounds.

ABSTRACTED-PUB-NO: WO 200183761A
EQUIVALENT-ABSTRACTS:

CHOSEN-DRAWING: Dwg.0/0

DERWENT-CLASS: D16 D25
CPI-CODES: D05-A02; D05-H12E; D05-H14A1; D05-H14A2; D05-H17B3; D11-B01; D11-B02;

WEST

End of Result Set



Generate Collection

Print

L5: Entry 17 of 17

File: DWPI

Jun 25, 1998

DERWENT-ACC-NO: 1998-362768

DERWENT-WEEK: 199831

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TITLE: New laccase variants with improved stability - having amino acid changes based on Coprinus laccase structure, used for e.g. oxidation, dye transfer inhibition or bleaching

INVENTOR: CHERRY, J R; PEDERSEN, A H ; RASMUSSEN, G ; SCHNEIDER, P ; SVENDSEN, A ; CHERRY, J

PATENT-ASSIGNEE: NOVO-NORDISK AS (NOVO), NOVO NORDISK AS (NOVO), NOVOZYMES AS (NOVO)

PRIORITY-DATA: 1997DK-0001021 (September 8, 1997), 1996DK-0001449 (December 19, 1996)

PATENT-FAMILY:

PUB-NO	PUB-DATE	LANGUAGE	PAGES	MAIN-IPC
WO 9827198 A1	June 25, 1998	E	167	C12N009/02
AU 9853101 A	July 15, 1998		000	C12N009/02
EP 956345 A1	November 17, 1999	E	000	C12N009/02
US 5998353 A	December 7, 1999		000	C11D003/48
US 6140092 A	October 31, 2000		000	C12N009/02
US 6277611 B1	August 21, 2001		000	C12N009/02

DESIGNATED-STATES: AL AM AT AU AZ BA BB BG BR BY CA CH CN CU CZ DE DK EE ES FI GB GE GH GM HU ID IL IS JP KE KG KP KR KZ LC LK LR LS LT LU LV MD MG MK MN MW MX NO NZ PL PT RO RU SD SE SG SI SK SL TJ TM TR TT UA UG UZ VN YU ZW AT BE CH DE DK EA ES FI FR GB GH GM GR IE IT KE LS LU MC MW NL OA PT SD SE SZ UG ZW AT BE CH DE DK ES FI FR GB GR IE IT LI NL PT SE

APPLICATION-DATA:

PUB-NO	APPL-DATE	APPL-NO	DESCRIPTOR
WO 9827198A1	December 16, 1997	1997WO-DK00571	
AU 9853101A	December 16, 1997	1998AU-0053101	
AU 9853101A		WO 9827198	Based on
EP 956345A1	December 16, 1997	1997EP-0949990	
EP 956345A1	December 16, 1997	1997WO-DK00571	
EP 956345A1		WO 9827198	Based on
US 5998353A	January 23, 1997	1997US-035413P	Provisional
US 5998353A	December 18, 1997	1997US-0993318	
US 6140092A	January 23, 1997	1997US-035413P	Provisional
US 6140092A	December 18, 1997	1997US-0993318	Div ex
US 6140092A	September 21, 1999	1999US-0399886	
US 6140092A		US 5998353	Div ex
US 6277611B1	January 23, 1997	1997US-035413P	Provisional
US 6277611B1	December 18, 1997	1997US-0993318	Div ex
US 6277611B1	September 21, 1999	1999US-0399886	Cont of
US 6277611B1	May 23, 2000	2000US-0576281	
US 6277611B1		US 5998353	Div ex
US 6277611B1		US 6140092	Cont of

INT-CL (IPC): C11 D 3/48; C11 D 7/42; C12 N 9/02; C12 N 15/09; C12 N 9/02; C12 R 1:645; C12 N 9/02; C12 R 1:645

ABSTRACTED-PUB-NO: US 5998353A

BASIC-ABSTRACT:

A method (A) for constructing a variant of a parent Coprinus laccase (CL) which has laccase activity and improved stability as compared to the parent laccase, comprises: (a) analysing the structure of the parent CL to identify at least one amino acid residue or at least one structural part of the CL structure, which amino acid residue or structural part is believed to be of relevance for altering the stability of the parent CL (as evaluated on the basis of structural or functional considerations); (b) constructing a CL variant, which as compared to the parent CL, has been modified in the amino acid residue or structural part identified in (a) so as to alter the stability, and optionally: (c) testing the resulting CL variant with respect to stability.

Also claimed are:

(1) a variant of a parent CL comprising the 539 amino acid (aa) sequence given in the specification with mutations at positions corresponding to at least one of the following positions: W125, Y134, Y126, Y170, M75, and/or M477;

(2) a method of constructing a variant of a parent Coprinus-like laccase (CLL) which has laccase activity and improved stability as compared to the parent laccase, comprising: (a) comparing the 3-dimensional structure of the CL with the structure of a CLL; (b) identifying a part of the CLL structure which is different from the CL structure and which from structural or functional considerations is contemplated to be responsible for differences in the stability of the CL and CLL; (c) modifying the part of the CLL identified in (b) whereby a CLL variant is obtained, which has an improved stability compared to the parent CLL; and optionally (d) testing the resulting CLL variant with respect to stability;

(3) a variant of a parent Polyporus pinsitus (I) laccase which comprises the 499 aa sequence given in the specification with mutations at positions corresponding to at least one of the following: W107, Y116, Y108, Y152, M57; and/or M328;

(4) a variant of a parent Polyporus pinsitus (II) laccase, which comprises another 499 aa sequence (different from the sequence as in (3)) with mutations at positions corresponding to at least one of the following: W107, Y116, Y108, Y152, and/or M57;

- (5) a variant of a parent *Phlebia radiata* laccase, comprising the 548 aa sequence given in the specification with mutations at positions corresponding to at least one of the following: W128, Y137, &129, Y137, and/or M78;
- (6) a variant of a parent *Rhizoctonia solani* (I) laccase, comprising 529 aa sequence given in the specification with mutations at positions corresponding to at least one of the following; W126, Y135, Y127, Y171, and/or M76;
- (7) a variant of a parent *R. solani* (II) laccase comprising the 599 aa sequence given in the specification with mutations at positions corresponding to at least one of the following: W439, W125, Y134, Y126, Y170, and/or M75;
- (8) a variant of a parent *R. solani* (III) laccase comprising the 572 aa sequence given in the specification with mutations at positions corresponding to at least one of the following: W411, W125, Y134, Y126, Y170 and/or M75;
- (9) a variant of a parent *R. solani* (IV) laccase comprising the 575 aa sequence given in the specification with mutations at positions corresponding to at least one of the following: W411, W125, Y134, Y126, Y170, and/or M75;
- (10) a variant of a parent *Scytalidium thermophilum* laccase comprising the 616 aa sequence given in the specification with mutations at positions corresponding to at least one of the following: M483, W422, W181, Y190, M530, Y182, Y221, M300 and/or M313;
- (11) a variant of a parent *Myceliophthora thermophila* laccase comprising the 573 aa sequence given in the specification with mutations at positions corresponding to at least one of the following: W507, M433, W373, W136, Y145, M480, Y137, Y176, and/or M254;
- (12) a DNA construct comprising a DNA sequence encoding a laccase variant as in (1) or (3)-(11);
- (13) a recombinant expression vector which comprises the DNA construct as in (12);
- (14) a cell transformed with a DNA construct as in (12) or a vector as in (13).

USE - The laccase variants can be used as in detergent additives and may optionally be used in a composition additionally comprising proteases, lipases, amylases, cellulases and surfactants (claimed). The laccase variants can be used for oxidising substrates in e.g. dye transfer inhibition in detergents, bleaching of textiles (in particular bleaching of denim) (both claimed); lignin modification, paper strengthening, phenol polymerisation, hair dyeing and waste water treatment.

ABSTRACTED-PUB-NO: US 6140092A
EQUIVALENT-ABSTRACTS:

A method (A) for constructing a variant of a parent *Coprinus* laccase (CL) which has laccase activity and improved stability as compared to the parent laccase, comprises: (a) analysing the structure of the parent CL to identify at least one amino acid residue or at least one structural part of the CL structure, which amino acid residue or structural part is believed to be of relevance for altering the stability of the parent CL (as evaluated on the basis of structural or functional considerations); (b) constructing a CL variant, which as compared to the parent CL, has been modified in the amino acid residue or structural part identified in (a) so as to alter the stability, and optionally: (c) testing the resulting CL variant with respect to stability.

Also claimed are:

- (1) a variant of a parent CL comprising the 539 amino acid (aa) sequence given in the specification with mutations at positions corresponding to at least one of the following positions: W125, Y134, Y126, Y170, M75, and/or M477;
- (2) a method of constructing a variant of a parent *Coprinus*-like laccase (CLL) which

has laccase activity and improved stability as compared to the parent laccase, comprising: (a) comparing the 3-dimensional structure of the CL with the structure of a CLL; (b) identifying a part of the CLL structure which is different from the CL structure and which from structural or functional considerations is contemplated to be responsible for differences in the stability of the CL and CLL; (c) modifying the part of the CLL identified in (b) whereby a CLL variant is obtained, which has an improved stability compared to the parent CLL; and optionally (d) testing the resulting CLL variant with respect to stability;

(3) a variant of a parent *Polyporus pinsitus* (I) laccase which comprises the 499 aa sequence given in the specification with mutations at positions corresponding to at least one of the following: W107, Y116, Y108, Y152, M57; and/or M328;

(4) a variant of a parent *Polyporus pinsitus* (II) laccase, which comprises another 499 aa sequence (different from the sequence as in (3)) with mutations at positions corresponding to at least one of the following: W107, Y116, Y108, Y152, and/or M57;

(5) a variant of a parent *Phlebia radiata* laccase, comprising the 548 aa sequence given in the specification with mutations at positions corresponding to at least one of the following: W128, Y137, &129, Y137, and/or M78;

(6) a variant of a parent *Rhizoctonia solani* (I) laccase, comprising 529 aa sequence given in the specification with mutations at positions corresponding to at least one of the following; W126, Y135, Y127, Y171, and/or M76;

(7) a variant of a parent *R. solani* (II) laccase comprising the 599 aa sequence given in the specification with mutations at positions corresponding to at least one of the following: W439, W125, Y134, Y126, Y170, and/or M75;

(8) a variant of a parent *R. solani* (III) laccase comprising the 572 aa sequence given in the specification with mutations at positions corresponding to at least one of the following: W411, W125, Y134, Y126, Y170 and/or M75;

(9) a variant of a parent *R. solani* (IV) laccase comprising the 575 aa sequence given in the specification with mutations at positions corresponding to at least one of the following: W411, W125, Y134, Y126, Y170, and/or M75;

(10) a variant of a parent *Scytalidium thermophilum* laccase comprising the 616 aa sequence given in the specification with mutations at positions corresponding to at least one of the following: M483, W422, W181, Y190, M530, Y182, Y221, M300 and/or M313;

(11) a variant of a parent *Myceliophthora thermophila* laccase comprising the 573 aa sequence given in the specification with mutations at positions corresponding to at least one of the following: W507, M433, W373, W136, Y145, M480, Y137, Y176, and/or M254;

(12) a DNA construct comprising a DNA sequence encoding a laccase variant as in (1) or (3) - (11);

(13) a recombinant expression vector which comprises the DNA construct as in (12);

(14) a cell transformed with a DNA construct as in (12) or a vector as in (13).

USE - The laccase variants can be used as in detergent additives and may optionally be used in a composition additionally comprising proteases, lipases, amylases, cellulases and surfactants (claimed). The laccase variants can be used for oxidising substrates in e.g. dye transfer inhibition in detergents, bleaching of textiles (in particular bleaching of denim) (both claimed); lignin modification, paper strengthening, phenol polymerisation, hair dyeing and waste water treatment.

A method (A) for constructing a variant of a parent *Coprinus* laccase (CL) which has laccase activity and improved stability as compared to the parent laccase, comprises: (a) analysing the structure of the parent CL to identify at least one amino acid residue or at least one structural part of the CL structure, which amino acid residue

or structural part is believed to be of relevance for altering the stability of the parent CL (as evaluated on the basis of structural or functional considerations); (b) constructing a CL variant, which as compared to the parent CL, has been modified in the amino acid residue or structural part identified in (a) so as to alter the stability, and optionally: (c) testing the resulting CL variant with respect to stability.

Also claimed are:

(1) a variant of a parent CL comprising the 539 amino acid (aa) sequence given in the specification with mutations at positions corresponding to at least one of the following positions: W125, Y134, Y126, Y170, M75, and/or M477;

(2) a method of constructing a variant of a parent Coprinus-like laccase (CLL) which has laccase activity and improved stability as compared to the parent laccase, comprising: (a) comparing the 3-dimensional structure of the CL with the structure of a CLL; (b) identifying a part of the CLL structure which is different from the CL structure and which from structural or functional considerations is contemplated to be responsible for differences in the stability of the CL and CLL; (c) modifying the part of the CLL identified in (b) whereby a CLL variant is obtained, which has an improved stability compared to the parent CLL; and optionally (d) testing the resulting CLL variant with respect to stability;

(3) a variant of a parent Polyporus pinsitus (I) laccase which comprises the 499 aa sequence given in the specification with mutations at positions corresponding to at least one of the following: W107, Y116, Y108, Y152, M57; and/or M328;

(4) a variant of a parent Polyporus pinsitus (II) laccase, which comprises another 499 aa sequence (different from the sequence as in (3)) with mutations at positions corresponding to at least one of the following: W107, Y116, Y108, Y152, and/or M57;

(5) a variant of a parent Phlebia radiata laccase, comprising the 548 aa sequence given in the specification with mutations at positions corresponding to at least one of the following: W128, Y137, &129, Y137, and/or M78;

(6) a variant of a parent Rhizoctonia solani (I) laccase, comprising 529 aa sequence given in the specification with mutations at positions corresponding to at least one of the following: W126, Y135, Y127, Y171, and/or M76;

(7) a variant of a parent R. solani (II) laccase comprising the 599 aa sequence given in the specification with mutations at positions corresponding to at least one of the following: W439, W125, Y134, Y126, Y170, and/or M75;

(8) a variant of a parent R. solani (III) laccase comprising the 572 aa sequence given in the specification with mutations at positions corresponding to at least one of the following: W411, W125, Y134, Y126, Y170 and/or M75;

(9) a variant of a parent R. solani (IV) laccase comprising the 575 aa sequence given in the specification with mutations at positions corresponding to at least one of the following: W411, W125, Y134, Y126, Y170, and/or M75;

(10) a variant of a parent Scytalidium thermophilum laccase comprising the 616 aa sequence given in the specification with mutations at positions corresponding to at least one of the following: M483, W422, W181, Y190, M530, Y182, Y221, M300 and/or M313;

(11) a variant of a parent Myceliophthora thermophila laccase comprising the 573 aa sequence given in the specification with mutations at positions corresponding to at least one of the following: W507, M433, W373, W136, Y145, M480, Y137, Y176, and/or M254;

(12) a DNA construct comprising a DNA sequence encoding a laccase variant as in (1) or (3)-(11);

(13) a recombinant expression vector which comprises the DNA construct as in (12);

(14) a cell transformed with a DNA construct as in (12) or a vector as in (13).

USE - The laccase variants can be used as in detergent additives and may optionally be used in a composition additionally comprising proteases, lipases, amylases, cellulases and surfactants (claimed). The laccase variants can be used for oxidising substrates in e.g. dye transfer inhibition in detergents, bleaching of textiles (in particular bleaching of denim) (both claimed); lignin modification, paper strengthening, phenol polymerisation, hair dyeing and waste water treatment.

US 6277611B

A method (A) for constructing a variant of a parent *Coprinus* laccase (CL) which has laccase activity and improved stability as compared to the parent laccase, comprises: (a) analysing the structure of the parent CL to identify at least one amino acid residue or at least one structural part of the CL structure, which amino acid residue or structural part is believed to be of relevance for altering the stability of the parent CL (as evaluated on the basis of structural or functional considerations); (b) constructing a CL variant, which as compared to the parent CL, has been modified in the amino acid residue or structural part identified in (a) so as to alter the stability, and optionally: (c) testing the resulting CL variant with respect to stability.

Also claimed are:

(1) a variant of a parent CL comprising the 539 amino acid (aa) sequence given in the specification with mutations at positions corresponding to at least one of the following positions: W125, Y134, Y126, Y170, M75, and/or M477;

(2) a method of constructing a variant of a parent *Coprinus*-like laccase (CLL) which has laccase activity and improved stability as compared to the parent laccase, comprising: (a) comparing the 3-dimensional structure of the CL with the structure of a CLL; (b) identifying a part of the CLL structure which is different from the CL structure and which from structural or functional considerations is contemplated to be responsible for differences in the stability of the CL and CLL; (c) modifying the part of the CLL identified in (b) whereby a CLL variant is obtained, which has an improved stability compared to the parent CLL; and optionally (d) testing the resulting CLL variant with respect to stability;

(3) a variant of a parent *Polyporus pinsitus* (I) laccase which comprises the 499 aa sequence given in the specification with mutations at positions corresponding to at least one of the following: W107, Y116, Y108, Y152, M57; and/or M328;

(4) a variant of a parent *Polyporus pinsitus* (II) laccase, which comprises another 499 aa sequence (different from the sequence as in (3)) with mutations at positions corresponding to at least one of the following: W107, Y116, Y108, Y152, and/or M57;

(5) a variant of a parent *Phlebia radiata* laccase, comprising the 548 aa sequence given in the specification with mutations at positions corresponding to at least one of the following: W128, Y137, &129, Y137, and/or M78;

(6) a variant of a parent *Rhizoctonia solani* (I) laccase, comprising 529 aa sequence given in the specification with mutations at positions corresponding to at least one of the following; W126, Y135, Y127, Y171, and/or M76;

(7) a variant of a parent *R. solani* (II) laccase comprising the 599 aa sequence given in the specification with mutations at positions corresponding to at least one of the following: W439, W125, Y134, Y126, Y170, and/or M75;

(8) a variant of a parent *R. solani* (III) laccase comprising the 572 aa sequence given in the specification with mutations at positions corresponding to at least one of the following: W411, W125, Y134, Y126, Y170 and/or M75;

(9) a variant of a parent *R. solani* (IV) laccase comprising the 575 aa sequence given in the specification with mutations at positions corresponding to at least one of the

following: W411, W125, Y134, Y126, Y170, and/or M75;

(10) a variant of a parent *Scytalidium thermophilum* laccase comprising the 616 aa sequence given in the specification with mutations at positions corresponding to at least one of the following: M483, W422, W181, Y190, M530, Y182, Y221, M300 and/or M313;

(11) a variant of a parent *Myceliophthora thermophila* laccase comprising the 573 aa sequence given in the specification with mutations at positions corresponding to at least one of the following: W507, M433, W373, W136, Y145, M480, Y137, Y176, and/or M254;

(12) a DNA construct comprising a DNA sequence encoding a laccase variant as in (1) or (3) - (11);

(13) a recombinant expression vector which comprises the DNA construct as in (12);

(14) a cell transformed with a DNA construct as in (12) or a vector as in (13).

USE - The laccase variants can be used as in detergent additives and may optionally be used in a composition additionally comprising proteases, lipases, amylases, cellulases and surfactants (claimed). The laccase variants can be used for oxidising substrates in e.g. dye transfer inhibition in detergents, bleaching of textiles (in particular bleaching of denim) (both claimed); lignin modification, paper strengthening, phenol polymerisation, hair dyeing and waste water treatment.

WO 9827198A

CHOSEN-DRAWING: Dwg.0/0

DERWENT-CLASS: A60 D16 D25 F06 F09

CPI-CODES: A11-A01; A12-S05N; A12-S05P; D05-A02A; D05-H12B; D05-H12E; D05-H14; D05-H18; D11-B02; F03-B01; F03-J03; F05-A06D;

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L5: Entry 13 of 17

File: USPT

Jul 20, 1999

US-PAT-NO: 5925554

DOCUMENT-IDENTIFIER: US 5925554 A

TITLE: Myceliophthora and scytalidium laccase variants

DATE-ISSUED: July 20, 1999

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Pedersen; Anders Hjelholt	Lyngby			DK
Svensen; Allan	Birker.o slashed.d			DK
Schneider; Palle	Ballerup			DK
Rasmussen; Grethe	Farum			DK
Cherry; Joel	Hellerup			DK

US-CL-CURRENT: 435/189; 510/320, 510/392

CLAIMS:

We claim:

1. A variant polypeptide having laccase activity and improved stability as compared to a parent laccase, wherein said parent laccase has the amino acid sequence depicted in SEQ ID No. 1 or has an amino acid sequence at least 80% homologous to SEQ ID No. 1. and wherein said variant polypetide comprises a mutation at one or more positions corresponding to positions selected from the group consisting of Trp13, Tyr17, Tyr23, Tyr36, Trp46, Met58, Trp73, Trp94, Trp136, Tyr137, Tyr145, Tyr175, Tyr176, Tyr177, Tyr214, Met254, Met260, Tyr273, Tyr286, Trp287, Tyr305, Trp384, Tyr391, Tyr403, Trp414, Tyr416, Trp417, Tyr441, Met480, Trp486, Tyr517, Trp543, Tyr546, Trp547, Tyr552, Trp563, and Trp569 of SEO ID NO: 1 or equivalent positions thereof in said homologous parent laccase sequences.
2. A variant polypeptide according to claim 1, wherein said position is selected from the group consisting of: Trp136, Tyr145, Met480, Tyr137, Tyr176, Met254, and combinations of any of the foregoing.
3. A variant polypeptide according to claim 1, wherein the parent laccase is derived from Myceliophthora.
4. A variant polypeptide according to claim 1, wherein the parent laccase is derived from Scytalidium.
5. A variant polypeptide according to claim 4, wherein the parent laccase is a Scytalidium thermophilum laccase with the sequence ID No. 2.
6. A variant according to claim 5, which comprises a mutation in a position corresponding to a position in SEQ ID No. 2 selected from the group consisting of: Trp181, Tyr190, Met530, Tyr182, Tyr221, Met300, Met313, and combinations of any of the foregoing.
7. A detergent additive comprising a variant polypeptide according to claim 1 in the form of a non-dusting granulate, a stabilised liquid or a protected enzyme.

8. A detergent additive according to claim 7, further comprising one or more other enzymes selected from the group consisting of a protease, a lipase, an amylase, and a cellulase.

9. A detergent composition comprising a variant polypeptide according to claim 1 and a surfactant.

10. A detergent composition according to claim 9 further comprising one or more other enzymes selected from the group consisting of a protease, a lipase, an amylase and a cellulase.